United States Department of Agriculture
Agricultural Research Service

EASTERN REGIONAL RESEARCH CENTER FACT SHEET

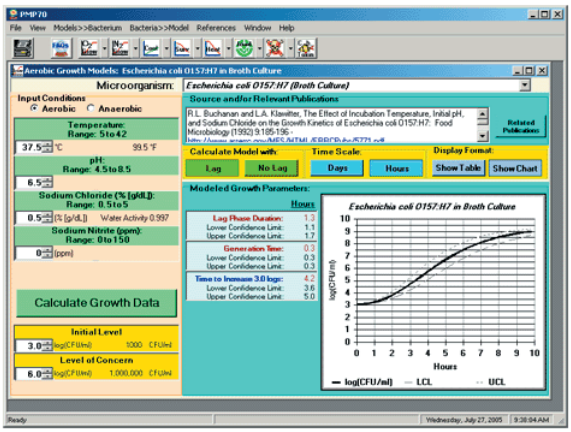
Microbial Modeling & Bioinformatics for Food Safety and Security

Program Background

Understanding the risks of bacterial foodborne illness depends on knowledge of specific environmental conditions that affect pathogen behavior (i.e., growth, survival and decline). This information can be translated into mathematical models that allow food safety managers to estimate how specific pathogens will react to unique environmental conditions.

Such models are used by food industries to develop new product formulations that minimize pathogen growth, and to design and implement Hazard Analysis & Critical Control Points (HACCP) food safety systems. Predictive models also provide risk analysts with efficient tools to define intervention strategies and policies that reduce the risk of foodborne disease.

The ARS Pathogen Modeling Program (PMP; http://www.arserrc.gov/mfs/pathogen.htm) is a software package of microbial models and a research product of the Microbial Food Safety Research Unit (MFS) that is meeting the needs of ARS customers in government, industry and academia. The PMP contains models that allow users to predict food formulation, processing and handling conditions that control the growth, survival and death of various bacterial foodborne pathogens.



ComBase (www.combase.cc), a collaborative project between ARS and the UK Institute of Food Research, contains over 30,000 records of microbial responses to food environments. This tool brings vast amounts of data to food safety managers and risk assessors for estimating the fate of bacteria in diverse types of foods.

Research Objectives

The Microbial Modeling & Bioinformatics for Food Safety & Security research team is addressing the following high priority research topics:

- Developing and validating new predictive models for estimating the responses of microbial pathogens in select food matrices, as a function of food formulation, competitive flora, thermal inactivation, and process unit operations.
- Producing new and objective measures for assessing model performance and robustness.
- Determining strategies that can be used to reduce the uncertainty of predicting bacterial lag times.

Impact

This research has resulted in the following accomplishments:

- Models that predict the growth of *Clostridium perfringens* and *Clostridium botulinum* in ready-to-eat meats, which provide the scientific basis for regulatory performance standards/compliance guidelines.
- Growth models for *Escherichia coli O157:H7* in raw ground beef that are assisting food companies in meeting regulatory standards.
- Models that help food safety managers control the growth of *Listeria monocytogenes* in delicatessen salads (seafood, ham, potato) under refrigeration and temperature-abuse conditions.

These research products are used extensively by the food industry and the USDA Food Safety & Inspection Service to design, implement and evaluate HACCP plans. Each year, the PMP is downloaded from the MFS website by more than 5,000 users in numerous countries. These predictive models also fill important risk assessment knowledge gaps, thus producing more accurate estimations of foodborne hazards. Current initiatives also include enhancing the PMP and ComBase software so that they better assist small and very small food companies in meeting food regulations and performance standards.

Principal Investigators

Saumya Bhaduri, Ph.D.
Microbiologist (Molecular Biology)
tel. 215-233-6521
fax. 215-233-6581
sbhaduri@errc.ars.usda.gov

Andy Hwang, Ph.D.
Research Food Technologist
tel. 215-233-6416
fax. 215-233-6581
ahwang@errc.ars.usda.gov

Vijay Juneja, Ph.D.
Microbiologist
tel. 215-233-6500
fax. 215-233-6581
vjuneja@errc.ars.usda.gov

Shiowshuh Sheen, Ph.D.
Research Food Technologist
tel. 215-836-3774
fax. 215-233-6581
ssheen@errc.ars.usda.gov

Mark L. Tamplin, Ph.D.
Microbiologist/Lead Scientist
tel. 215-836-3794
fax. 215-233-6581
mtamplin@errc.ars.usda.gov

For additional information contact Mark Tamplin mtamplin@errc.ars.usda.gov; tel: (215) 836-3794

Support Scientists

Kenyetta Chaney, B.S.
Biological Science Laboratory Technician
tel. 215-836-3749
fax. 215-233-6581
kchaney@errc.ars.usda.gov

Paul Edworthy, B.S.
Biological Science Technician
tel. 215-233-6798
fax. 215-233-6581
pedworthy@errc.ars.usda.gov

Tanishia Lawson, B.S.
Biological Science Laboratory Technician
tel. 215-836-3768
fax. 215-233-6581
tlawson@errc.ars.usda.gov

Angie Martinez, B.S.
Biologist
tel. 215-233-6425
fax. 215-233-6581
amartinez@errc.ars.usda.gov

Benne S. Marmer, B.S.
Microbiologist
tel. 215-836-3790
fax. 215-233-6581
bmarmer@errc.ars.usda.gov

Tod E. Stewart, M.S.
Biological Science Laboratory Technician
tel. 215-836-3748
fax. 215-233-6581
tstewart@errc.ars.usda.gov